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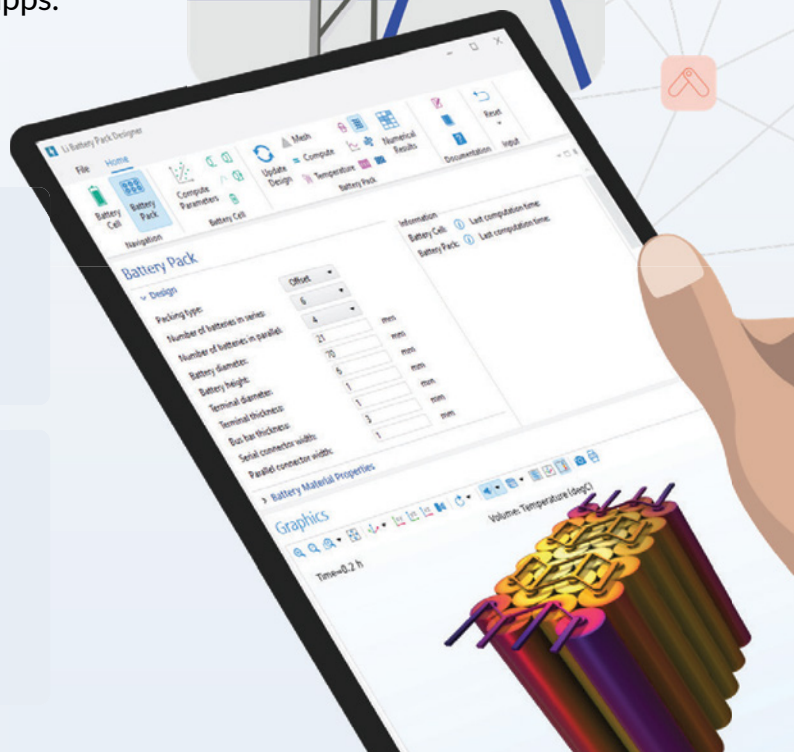
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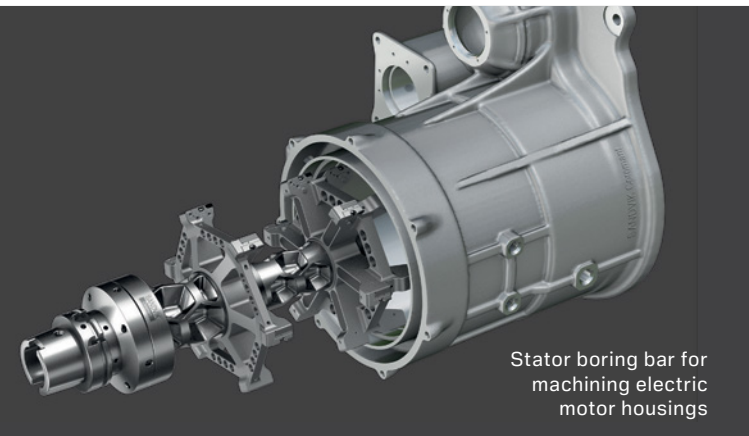
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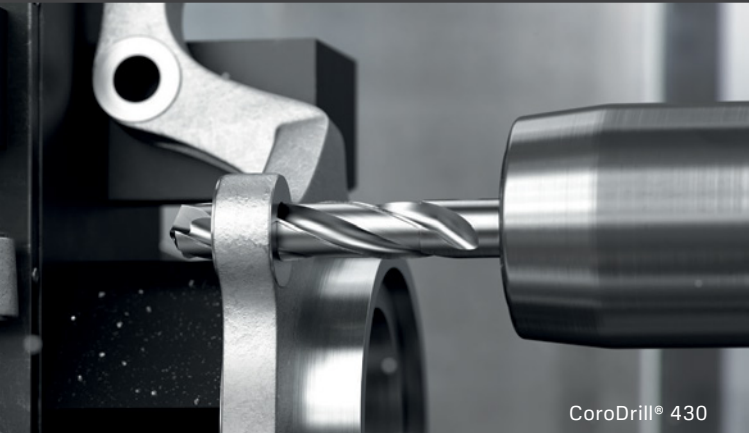
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Safety is a multi-point challenge. (Image: AntonioKalini/shutterstock.com)

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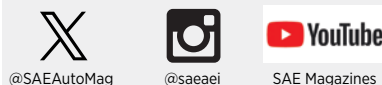
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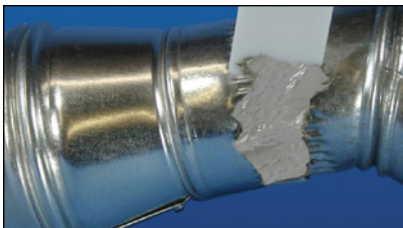
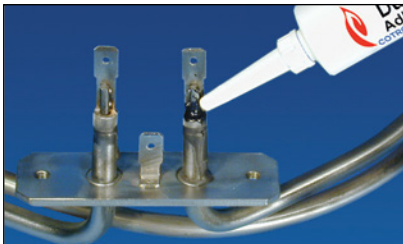
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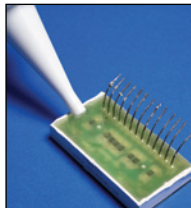
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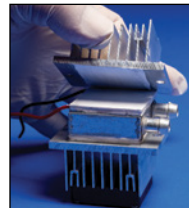
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EDITORIAL

IAA Mobility 2025: A new class of auto show

Aside from in this editorial, you won't find mention of the just-concluded IAA Mobility 2025 event in Munich in this issue. Print deadlines meant that the best I was able to offer in terms of coverage was this column. This year's IAA was what I (and many people I spoke with at the show) now consider one of the most engaging and exciting mobility shows we've had in years. We'll have the details for you in our next issue, and the various articles and interviews will be available at our new website (sae.org) well before then. If you've been following news and social media reports from the show, or were on site yourself, perhaps you came away with a similar impression: auto shows are dead, long live the mobility show.

As the first production model on BMW's Neue Klasse platform, the 2026 BMW iX3 stole the show this year. It wasn't just that hometown BMW got to hold the first major OEM press conference on the schedule. It wasn't just the billboards plastered throughout town. For me, proof that what BMW announced is worth paying attention to is how many suppliers and partners that worked with BMW on this massive project were excited to hitch their oxen to the Neue Klasse wagon.

AISIN proudly said it would build motors to BMW's specifications for future Neue Klasse models. Munich startup DeepDrive showed off its dual-rotor motor and touted BMW's early investment in the technology. But there was no bigger partner here than Qualcomm, which jointly developed the automated driving software stack in the Neue Klasse with BMW and held joint tech sessions to discuss the partnership during IAA.

Qualcomm is providing the Snapdragon Ride Pilot Automated Driving System, powered by Snapdragon Ride system-on-chips, for the 2027 iX3

when it launches next year. But semiconductor supplier Qualcomm's "superbrains" won't only be found in one model or even just on Neue Klasse vehicles. While BMW considers the co-developed technology, the high-performance control unit nicknamed the "Heart of Joy," to be the center of the Neue Klasse, some of its advanced driving capabilities will also be available to other automakers and suppliers thanks to a non-exclusive contract for some of what Qualcomm provided.

If you're looking for a hint at just how big Qualcomm is thinking here, the company said the system is already validated for use in 60 countries, and is expected to be available in more than 100 countries by 2026. In other words, as big as the Neue Klasse was at IAA, when we look back in five years, its presence might seem small, by comparison.

For more on the Neue Klasse and IAA, check out the debut episode of the *SAE Automotive Engineering* podcast. We launch with a conversation I had with BMW at IAA, and editor Roberto Baldwin spoke with representatives from **Slate** during a visit to the company's Warsaw, Indiana, factory. Listen to them discuss their stripped-down approach to EVs on sae.org or wherever you get your podcasts.

IAA was about more than the Neue Klasse, as you'll read next issue. And not everyone in Munich was an IAA fan, as the protestors I saw getting arrested on the highway in front of a miles-long traffic jam far from the last exit on my way to the airport. We don't really need massive trade shows to redefine mobility, but if we are going to have them, may they all have an energy like this year's IAA.

Sebastian Blanco, Editor-in-Chief

Auto shows are dead, long live the mobility show.

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The New Supplier Strategy Playbook

The high rate of structural changes to the North American Light Vehicle market demands a new approach by the supply base towards strategic planning. A new Supplier Strategy Playbook is in order.

First, some historical perspective. For the last several decades, suppliers grew accustomed to a product cadence of approximately five years between all-new platforms and major revisions. In North America, we were constantly pressed to continue improving vehicle efficiency and reduce emissions. Improved powertrain efficiency, vehicle lightweighting, and the advent of enhanced aerodynamics helped an industry that required constant innovation. Additionally, many programs were global in scope, requiring production and tooling in the major regions to launch in close sequence with global scale in tow. Wash, Rinse, Repeat. The textbook for suppliers was complex, though relatively predictable.

Fast forward to today. Several changes signal a new approach.

Suppliers spent significant levels of capital and resources as they focused on the prospect of EV growth over the past decade, driven by global forces from China and the EU but also by political forces in the U.S. and Canada. Suffice to note that the speed of adoption is now a multi-speed affair at best, with China leading the way, the EU shifting into a lower gear, and the U.S. looking for neutral. This drives an extreme level of underutilized capital never experienced before.

One answer is to extend the lifecycle of many of the current ICE vehicles to improve capital utilization and reduce new capital outflow. In a market where fuel efficiency now takes a backseat (there are no real compliance penalties expected in the U.S.), the industry is adjusting. One should expect longer lifecycles with a focus on design improvements, less lightweighting and cost mitigation.



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The speed of [EV] adoption is now a multi-speed affair at best, with China leading the way, the EU shifting into a lower gear, and the U.S. looking for neutral.

Other factors are afoot. Potential tariff exposure from a reset of U.S. trade policy has most of the industry guessing as to the final outcome and optimal approach. For an industry that has been pummeled by COVID, chip shortages, labor inflation, union strikes, and now, tariff uncertainty, some normalcy is desired, though not expected.

The new playbook has several fresh chapters alongside some holdovers. One is integrating scenarios into future planning structures to allow for 'bounding' their markets. At S&P Global Mobility, we are finding more clients using this framing approach to inform critical decisions. Another is volume. In the past, volume was the savior for the bottom line. Nothing like a 17-million-unit NA light vehicle production market to fill the coffers. Constant issues such as vehicle affordability, high financing costs and labor inflation outline that the industry will need to focus on efficiency to drive the bottom line, as these volume levels are not likely any time soon.

Yet another is the extension of ICE programs and the delay or rescope of BEV programs (outlined in past columns you can read at sae.org), underscoring that suppliers need to be much more proactive with their OEM and Tier 1 customers when it comes to capacity expectations, contractual understandings and reduced efficiency as programs age past the original end date. Lastly, as the world's major markets shift to a multi-speed affair, trusting upon global economies of scale as a differentiator now becomes a questionable tactic.

The new supplier playbook demands a closer focus on capital allocation and operational efficiency, scenario planning to understand the boundaries and better alignment with one's supply base. It also outlines a greater understanding of your competitors, total addressable markets, margin optimization and flexibility. The last five years have taught us that anything is possible. It's time to approach strategic planning differently. ■



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ELECTRIFICATION

BMW brings EV motor production to Steyr in Austria



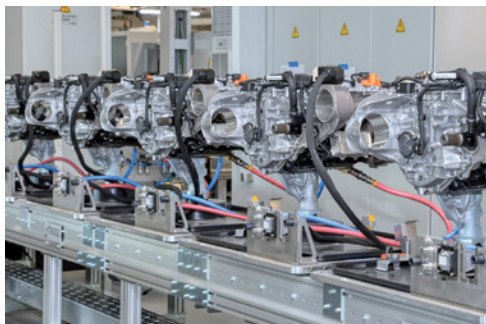
The electric motor for the sixth generation of BMW eDrive (Gen6) is the first fully-electric drivetrain to be produced at the Steyr location in Austria.

In August, the **BMW Group's** Plant Steyr in Austria started producing the electric motors for its Neue Klasse EVs. The sixth-generation BMW eDrive is the first all-electric drivetrain that will be built at Steyr, and Steyr is BMW's first production site for the Gen6 electric motor. In preparation, BMW announced in 2022 that, by 2030, the automaker would invest over a billion euros in the Steyr location to expand development and production expertise for electric motors.

"Three years ago, we announced that we would build this electric motor in Steyr. Today, we are proud to deliver it," said Klaus von Moltke, SVP of engine production for BMW AG and plant director at Steyr, said in a statement. "What we are launching here today is more than just a production ramp-up. It is a firm commitment to Europe, to technology and to the future."

BMW has, unsurprisingly, improved the tech in the sixth-generation BMW eDrive for the EVs that will use the company's new 800-volt vehicle architecture. There's an updated silicon carbide (SiC) power converter integrated into the electric motor housing and the two-stage spur gearbox was improved with a physical redesign, better cooling and reduced friction.

"Energy loss is reduced by 40%, costs by 20%, and weight by 10%. All this makes a significant contribution to the approximately 20% increase in overall vehicle efficiency", Martin



The efficient design of the powertrain and the high energy content of the high-voltage battery should provide a range of up to 800 km (497 miles) in the BMW iX3.

Kaufmann, SVP of global powertrain development at BMW AG, said in a statement. "The efficient design of the powertrain, together with the high energy content of the high-voltage battery, enable a range of up to 800 km (WLTP, 497 miles) in the BMW iX3, the first model of the Neue Klasse."

BMW will make the rotor, stator, transmission, and power converter for the new Gen6 motor at Plant Steyr. BMW needed to create a new in-house clean-room environment at Steyr to build the power converters. Meanwhile, the housings for the electric motor are cast at the BMW Plant Landshut aluminum foundry.

Almost 5,000 people work at Plant Steyr, which opened its doors over 40 years ago and has built around half of the engines used in all

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BMW and MINI vehicles today. To prepare for the Neue Klasse's electric engine production, BMW upgrades Plant Steyr by modernizing buildings and re-engineering its processes. The automaker said around 1,000 employees will work in the new electric engine assembly section, but if EV demand remains strong enough, half of Steyr's workforce could shift over to e-mobility efforts in the medium term. BMW said Plant Steyr will continue to make diesel and gasoline engines alongside the new Gen6 motors.

"Technology openness is our strength," Klaus von Moltke, head of engine production at BMW AG and plant director at Steyr, said in a statement. "It gives us the necessary flexibility to secure long-term jobs. Steyr will remain the heart of our drivetrain expertise, both for combustion engines and electromobility."

Sebastian Blanco

MANUFACTURING

Ford unveils its universal EV platform

In an August briefing, Ford's chief EV, digital and design chief Doug Field used the C word: China. Field said that the company's Universal EV Platform would through, "really radical innovation in things like efficiency and ease of manufacture, to make it affordable and to compete with folks like the Chinese through that innovation, not through just driving individual piece costs down."

Ford has delayed the refresh of the electric F-150 Lightning and E-Transit to focus on its new affordable EV strategy. According to Ford, the Universal EV Platform will have less wiring, will have 25% fewer fasteners, and be built 40% faster than the typical vehicle at the company's Louisville Assembly Plant. For customers, the end result is a four-door mid-sized pickup that targets a



Ford CEO Jim Farley speaks to workers and journalists at Ford's Kentucky Truck Plant in Louisville.

starting price of \$30,000.

During a press conference, Farley said, "We needed a radical approach and a tough challenge."

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The Kentucky Truck Plant currently builds many of Ford's larger vehicles, such as the F-250 pickup, Expedition SUV and Lincoln Navigator.

The name of the game for Ford is efficiency and trying to keep ahead of the looming threat of the Chinese EV market. Back in 2024, Ford CEO Jim Farley remarked that he didn't want to give up the electric **Xiaomi** SU7, he had imported from China. The vehicle built by a company better known in the United States for its phones was a huge success in China. Farley took notice.

"We started with a blank sheet to fight complexity and do something truly new, but we also relied on Ford and all of their experience so that we could make it real," Field said.

The unibody platform vehicle will be powered by prismatic LFP (lithium iron phosphate) batteries built at the automaker's BlueOval battery facility in Marshall, Michigan. The batteries cost less than lithium-ion batteries and are less prone to thermal runaway. Ford

says it's the first automaker to build LFP batteries in the United States.

That may be true for now, but the vehicle won't start production or come to market until 2027. That leaves an opening for other automakers to begin production of a vehicle with an LFP battery built in the U.S.

The yet-to-be-named pickup will be roughly the same size as the Ford Maverick, but Ford says it will have the same passenger space as a **Toyota** Rav4. The automaker boasted that it will be quicker than the EcoBoost Mustang. In a move likely to keep prices down, the platform will be based on a 400-volt architecture instead of the more efficient 800-volt architecture.

Even the **Hyundai Motor Group**, which has been ahead of the curve with its 800-volt EGMP architecture, is using a 400-volt variant of that platform for

its low-cost EVs. So we expect peak charging to top off somewhere around 200kW.

Ford says that range, battery size, and official charge times will be communicated later. We do know that the vehicle will have power output likely similar to the Pro Power system found on the F-150 Lightning. But, like most other information, we're short on any details.

We'll also have to wait for any information regarding the software platform. Ford does say that the vehicle is software-defined, but doesn't elaborate.

Build it

To achieve its goal, Ford is retooling the Louisville, Kentucky plant, investing \$2 billion. To speed up production, Ford has created a three-line system that merges into a single line. Managers called it an "assembly tree." To reduce parts, the front and rear of the vehicles will be large aluminum unicastings. These castings can be assembled separately and will join the structural battery line. The three lines and sections come together to form the final vehicle.

The result, according to Ford, is a vehicle that's built 40% quicker than the vehicles currently built at the plant. Ford is also working to speed up insourcing and automation and is targeting an overall speed improvement of 15%.

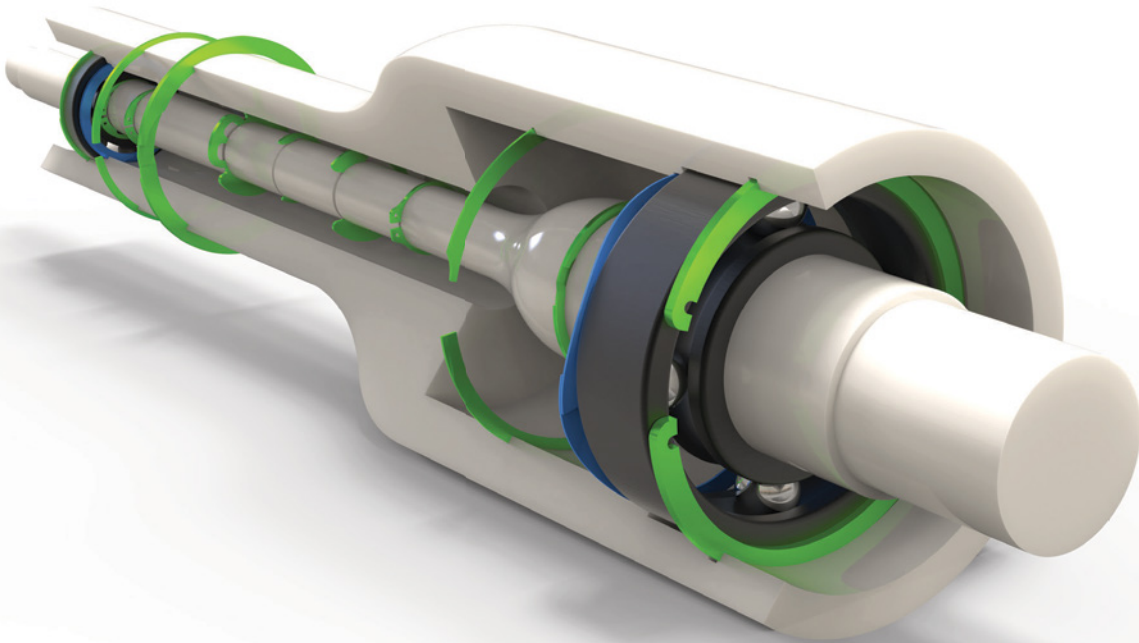
The three-line setup will also mean that workers will no longer have to reach through a door to install a dashboard. "We expect ergonomic breakthroughs and complexity reduction," Bryce Currie, Ford's vice president of Americas manufacturing said.

It's a new system for the automaker, and Farley notes that it's a gamble, "We're doing so many new things I can't tell you with a certainty that everything will go right."

It's a bold undertaking for both the vehicle and the building of that vehicle. Yet it's one that Ford believes it needs to take in order to take on both traditional competitors but also automotive startups and the looming threat from China.

Roberto Baldwin

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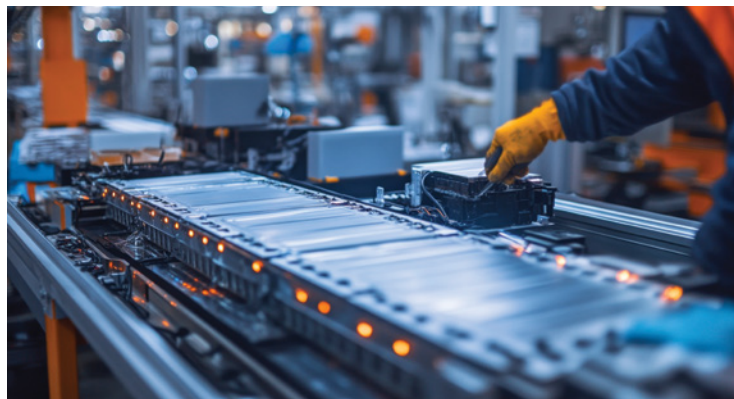
EV SAFETY

Revolutionizing EV battery safety: advanced coatings and composite solutions

Thermal runaway in electric vehicle (EV) batteries is rare, but it can happen, producing smoke, fire, and explosions. This uncontrollable, self-heating state can transfer intense heat to adjacent cells and cause pressure buildups that exceed the mechanical limits of cell casings. Since the gases that can form inside a battery cell are flammable, a spark or other ignition source could propagate fire or lead to an explosion and cause the violent venting of shrapnel or particulates, putting vehicle occupants and emergency responders at risk.

To support EV safety, silicone thermal management materials are placed between battery cells and between battery modules. For battery pack enclosures, however, mica sheets traditionally have been used as protective barriers. Mica provides thermal and electrical insulation, but sheets made of this mineral are limited in terms of thermal performance, mechanical durability, processability, and sustainable sourcing. To address these challenges, advanced silicone-based coatings and fiber-reinforced composite systems offer a transformative approach to the safety and manufacturing efficiency of battery enclosures and other EV battery components.

Next-generation, one-part silicone-based coatings that are designed for fire and blast protection resist flames and



Advanced fire- and blast-resistant coatings can accommodate the vertical surfaces and deep troughs associated with EV lids and side panels.

help contain violent venting by ceramifying at the high temperatures associated with thermal runaway incidents. Unlike traditional mica sheets, these coatings support automated dispensing for high-volume production. Plus, compared to two-part coatings, these new one-part coatings do not require time-consuming mixing. Manufacturers can also precisely dispense a thin layer of this material onto a battery pack surface instead of spraying the coating, which can generate material waste and requires covering or masking of areas that should not be sprayed.

Additionally, advanced fire- and blast-resistant coatings can accommodate the vertical surfaces and deep troughs associated with EV lids and

side panels. These materials also resist sagging on vertical panels and can fill the recessed areas that are used as cooling channels or to manage and direct the flow of hot gases away from other battery cells in the event of thermal runaway. This helps mitigate both thermal and electrical hazards. To further enhance safety and reliability for EV battery enclosures, fire- and blast-resistant coatings can be used in conjunction with next-generation, fiber-reinforced composite systems, such as flame-retardant polyurethane pultrusion solutions that provide significant performance, efficient processing, and cost advantages. These composite systems offer structural reinforcement, thermal insulation, and resistance to flame and grit. Their scalable design also supports continuous, high-throughput production across both simple and complex geometries.

Together, silicone coatings and flame-retardant polyurethane pultrusion solutions provide high-performance alternatives to traditional materials like mica and can be tailored to meet specific application needs while aligning with evolving safety standards. As EVs become more mainstream, these two advanced material technologies will be essential for building safer, more efficient and future-ready battery system.

Luc Dusart is global marketing manager of Mobility & Transportation at Dow and wrote this article for SAE Media.



Silicone coatings and flame-retardant polyurethane pultrusion solutions provide high-performance alternatives to traditional materials like mica.

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MANUFACTURING

Inside Slate's Warsaw factory



Slate's Indiana-wrapped Blank Slate vehicle.

Slate bought a factory. The 1.4 million sq. ft. (130,000 m³) facility was formerly a printing company. Sears, JCPenny, and Radio Shack catalogs emerged from the RR Donnelley & Sons printing plant for decades. Beginning late next year, Slate says it will begin production of its low-cost, highly customizable pickup truck.

Factory Settings

Slate held a community event recently to reiterate its dedication to bringing an EV to market starting in the “mid-

twenties.” CEO Chris Barman addressed the audience of community leaders, lawmakers, and press inside a brick and glass building that will eventually become a customer service center.

While smaller than a traditional automotive factory, the footprint of the Warsaw, Indiana, factory seems to be perfect for Slate's plans. The vehicle's gray molded exterior panels negate the need for an expensive and space-intensive paint shop. There is no need for large casting machines. Barman noted

that a typical pickup is built from 5,000 to 6,000 parts.

“The Blank Slate has just over 600 parts and one configuration,” Barman told the audience. “Let that sink in for a moment, just 10% of the parts of its typical truck to build upon. We're retooling the factory in such a way that truly allows for manufacturing simplicity and rapid scaling.”

That dedication to simplicity has a snowball effect on cost savings. In addition to not having to buy the parts, there are inventory savings, the factory line moves quicker because there are fewer items to put into the vehicle, and quality control becomes less intensive because again, fewer items.

“We removed everything that is in our car to improve reliability and efficiency and deliver the value customers want over time. Removing the unnecessary content gets back to the basics and allows customers to enjoy a simple and pure, thriving experience,” Barman said.

Simplifying the build while creating a vehicle that's incredibly customizable is a daunting task.

Simply Complex

“The team definitely had a different mindset and took a different approach



CEO Chris Barman addresses the audience at the Slate Factory event.

BOTH IMAGES: ROBERTO BALDWIN

in knowing that we wanted it to be accessorized,” Barman told SAE Media. “So you had to be very thoughtful about designing in accessory points or access points where you can very easily install the accessories, because we’re working to make it as Do It Yourself as possible, so that people can work on their vehicle.”

Barman also said that the design team had to figure out how to take multiple parts, merge them into a single part while also figuring out how to make sure that part fit in as a whole and allowed for the vehicle to be customized in the future by the owners, “It’s a lot of creativity, a lot of thinking about what the future use of the vehicle may be and how people may want it.”

Then, to “continue to refine it and improve it and see what you can do to bring the cost out, but not just the cost of the part, but the cost throughout the whole operation,” Barman said.



The Slate beta prototype truck on display at the factory.

Partners new and old

At its unveiling in Los Angeles in April, Slate announced its partnership with Korean battery makers **SK On**. At the

time, SK On CEO Lee Seok-hee told SAE Media, “When I first saw the presentation, I was immediately moved. Because in my mind, the general public

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Slate branding on its Warsaw, Indiana Factory.

really needed an affordable vehicle, and we're not offering that."

Slate may have found a friend in SK On, but not every company was initially sold on the idea. "We found a lot of really good partners that wanted to partner with us at that time (pre-launch), but we did see that there were some individuals who were, you know, hesitant. After we announced, and within a little over two weeks, we had over 100,000 reservations. It then opened more doors for us than what we had seen previously," Barman said.

As the Indiana event wound up, the eventual customer service center was abuzz with individuals mulling around the two Slate vehicles in the room. One is a pickup, the other a pickup outfitted to become an SUV with an Indiana-themed wrap. A nod to the community that helped make the revitalization of the factory possible.

"We found a great partner in the community here in Warsaw," Barman said.

The company says there's the potential that customers will be able to pick up their Blank Slate from the factory, and the delivery will happen in this building. No word on whether a delivery fee will still be charged in that instance.

The final employees left their jobs at the RR Donnelley & Sons printing plant for the last time in September 2023. In 2026, Slate is expected to build out and begin production, and that means new jobs for the region.

Some of those jobs might lead to employees buying the Slate truck, a deceptively simple vehicle that was designed to be built in a way that defies how current vehicles are brought to market.

Roberto Baldwin

QUALITY CONTROL

Upstream: better data collection, processing will reduce SDV recalls



The 2025 Bronco Sport, seen here in Heritage Edition trim, is just one model Ford had to recall in 2025 as part of a historic 100+ recalls in the first eight months of the year.

Cars that are more connected, equipped with more sensors than ever before, should make proactive maintenance somewhat easy and reliable.

Drivers could have lower repair costs and fewer breakdowns overall if the automotive industry shifts away from a periodic maintenance mindset towards data-driven proactive services. But the automakers themselves would also win with a massive drop in recalls.

A connected car requires accurate telemetry sensors to track details such as temperature (in the engine, battery, and cabin), pressure (in tires, fuel, and oil), electrical current/voltage, and vibration patterns to detect problems before they become failures. The vehicle also needs to be able to combine telemetry, diagnostics, metadata, and service records in one platform and then make sense of it all. "Poor data integration kills even the best analytics," according to **Upstream** co-founder and CTO Yonatan Appel.

Upstream, a provider of AI-powered cloud-based data management platform for automotive, smart mobility, and IoT ecosystems, released a report in July that looked at how connected vehicle data was and could be used in "next-generation after-sales quality strategies." Upstream advised OEMs to use connected car data not just to provide better customer service, but also to "better leverage data-driven detection and anal-

ysis to reduce the risk of high-impact recalls, warranty costs, and customer dissatisfaction," especially when it comes to EVs recalled for software issues.

The underlying problem, Appel told SAE Media, is that preventative tools in connected cars are not being used to their fullest extent. Upstream claimed in its report that 70% of all the recalls it studied – and nearly 90% of EV-related recalls – could have been detected earlier using connected vehicle data and AI. Appel agreed with SAE Media that those are pretty dramatic numbers.

"They are," he said. "We were surprised, but the AI-enriched data told the story."

Upstream singled out **Ford** for setting what Upstream called "an unfortunate industry record: 88 safety recall events in just the first half of 2025 - more than any automaker has ever reported in a full calendar year." Upstream pointed out that Ford might be the most visible example of the growing recall trend – since July, Ford has had to announce more recalls, and the number now stands at over 100 so far this year, affecting more than two million vehicles – but it's not the only OEM facing potential problems.

Upstream analyzed structured data from NHTSA's recall and complaints databases for its report, limiting the data to issues that occurred in 2020 or

later and that were associated with vehicle models from model year 2020 onward. Upstream removed records related to child car seats and tires from the dataset, which went through April 2025 for recall data and the end of 2024 for consumer complaint data. This left Upstream with a report that included insights from more than 5,000 recalls and 30,000 consumer complaints, as published by **NHTSA**. To prevent skewing the results with cross-model repetition, Upstream treated each recall campaign as a single record, with duplications across different affected vehicle models removed. Then, Upstream applied AI tools to enrich and classify the data.

“These processes enabled us to identify trends and categorize issues by various factors, like OEM vs. supplier, vehicle engine types such as EV and ICE, and related data signals,” Appel said.

For its part, Ford said it is aware of software problems.

“We are making progress on software quality, using an enhanced software validation process to help ensure the right software is present on vehicles and using over-the-air updates to address potential warranty issues before they become customer issues,” a spokesperson told SAE Media.

“Modern digital safety systems require new talent, tools, and standards. Ford has deeply invested in those capabilities like connected data signaling and dramatically increased testing on all new products across broad variations in customer use. We use multiple sources to detect quality issues, including social media, repair orders and connected vehicle data. Where possible, we’ll use over-the-air updates to repair software-related recall issues.

EVs, and SDV technology in general, offer both risk and the opportunity for early problem detection, Upstream said. Since EV platforms rely on software-defined, data-driven systems, their chance of succumbing to a large-scale recall is higher, even though that doesn’t have to be true. “EVs generate a continuous stream of operational insights that can be used for quality assurance:

nearly half (49%) of EV-related recalls could have been identified early through diagnostic trouble code (DTC) monitoring alone, compared to 37% for all recalls,” the company said.

“The bottom [line] is to get clean

data, provide proper context, and keep engineers in the loop,” Appel said.

“This approach catches quality issues quickly and helps to speed up the investigation process.”

Sebastian Blanco



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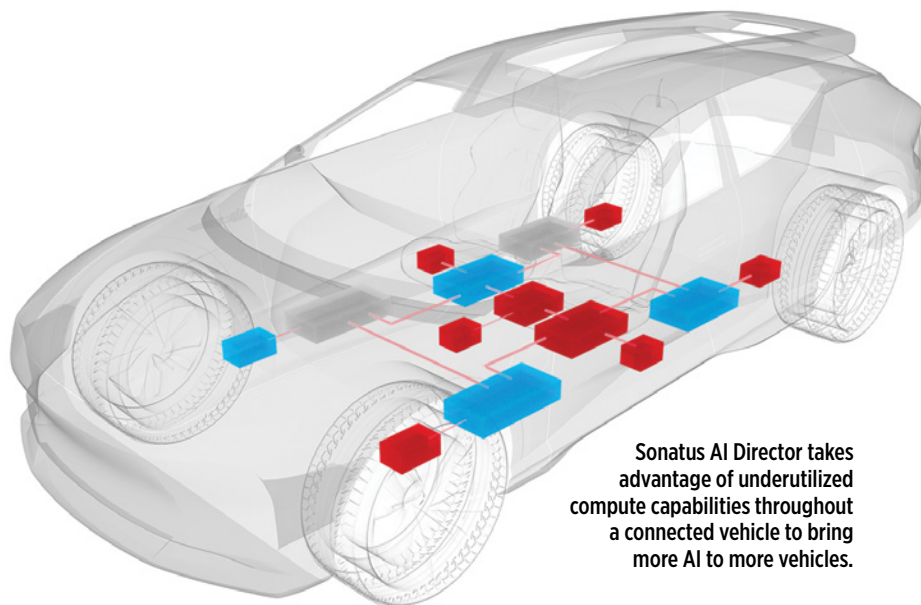
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Sonatus launches AI Director to integrate more AI in more vehicles



Sonatus AI Director takes advantage of underutilized compute capabilities throughout a connected vehicle to bring more AI to more vehicles.

Vehicle software company **Sonatus** wants the automotive industry to rethink the role of the middle manager. At least, when those managers are AI-based. The company unveiled its new AI Director end-to-end tool-chain software product in early September, calling it a “game-changing platform” that will allow OEMs to deploy AI at the vehicle edge without adding more compute. Sonatus will demonstrate AI Director for the first time in public at the IAA Mobility conference in Munich next week.

Sonatus’ basic message with AI Director is that AI has already been in our vehicles, but there’s room for growth outside of the current focus on powertrain and driving operations, space for smaller suppliers to contribute to the automotive AI ecosystem.

“There’s a whole class of AI that is not related to driving or assisted driving, for example, component or vehicle optimization,” Jeff Chou, Sonatus CEO and co-founder, told SAE Media. “Think about how you would potentially tune or manage or predict your battery range better. What about tire optimization? How would you predict tire wear better?

How would you tune your cameras or compensate these cheaper, consumer-grade, commodity cameras in the wake of varying temperature or weather?”

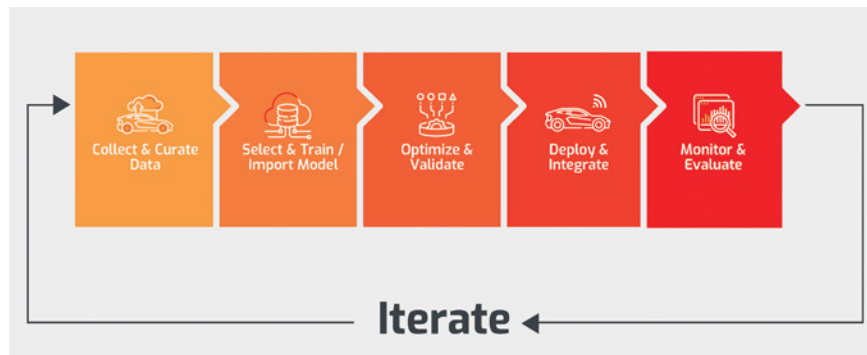
Another area where Sonatus believes AI can be useful is in anomaly detection, personalization or for dealer-owner coordination or cybersecurity. “The footprint of vulnerabilities is increasing,” Chou said. “It’s a natural use case for AI.” Earlier this year, Sonatus introduced its AI Technician product that helps consumers and engineers diagnose problems in a vehicle.

Partnering up

AI Director comes integrated with **NXP**’s eIQ Auto ML software. NXP is one of Sonatus’ launch partners, alongside **VicOne**, **Compredict**, and **Qnov**. Qnov, for example, tested AI Director with its Health & Safety Diagnostics (HSD) software to shorten the time-to-market for its battery safety software by identifying potential failures weeks in advance. Meanwhile, Compredict used AI Director to develop an AI-based Virtual Sensor that replaces standard ride height sensors with a software-only solution that will allow OEMs to add automatic headlight leveling to passenger vehicles (mandated in 2027 in Europe by UN R48-09) while saving money - a claimed up to \$20 per vehicle - by lowering bill-of-materials (BOM) costs.

“There’s a whole class of smaller, more narrowly focused AI applications that offer a lot of value across the board, not just to the driver, but the entire ecosystem, the entire value chain,” Chou said. “It’s not just your OEMs doing autonomous vehicles, and it’s not just Tier One suppliers doing ADAS. You have a whole new set that is broader and wider that can participate and innovate.”

To facilitate that innovation, Sonatus said it wants AI Director to give OEMs and suppliers “an end-to-end toolchain for model training, validation, optimization,



Sonatus AI Director goes through five stages - collect and curate data, select and train/import a model, optimize and validate, deploy and integrate and then monitor and evaluate - before iterating and cycling through the steps again.

and deployment,” both by bridging silos within an OEM as well as gaps between a model provider and the OEM itself. The low-requirement software is silicon- and hardware-agnostic.

There are two pieces of AI Director: an already-existing part in the cloud that processes data, including model training, optimization, and monitoring. The Sonatus AI Director supports physics- and neural network-based models and Small and Large Language Models (SLMs/LLMs). The piece in the car puts the model into what Chou called the “connective tissue” of all the signals moving across all the actuators and thus providing an environment for the lightweight, in-vehicle model to operate. Think of the cloud part as a management console, Sonatus CMO John Heinlein told SAE Media. “Everything we’re talking about in this announcement is about the AI that runs in the vehicle. If you think about software-defined vehicles, they are maybe not realizing their full complexity. They oftentimes already have the ability to do isolated workloads, just like your phone is not running one application, it’s running 20 applications at the same time and they don’t know the other ones are there. What we’re saying is, if you have spare headroom in the existing systems, we’re giving you a fresh, new way to consume it with new types of computes. If you have a little headroom, we’ll run a little. If you have a lot, we’ll run more.”

As an example of how an AI cybersecurity model operates under AI Director is that the software tells the model to run a few times a day to check for new threats, perhaps when the car is idle.

“The reality is that AI is a new way of coding algorithms and a new way of solving problems that’s fundamentally different,” Heinlein said. “There’s a spectrum of different AI, from more rudimentary models all the way through LLMs. Our goal here is to provide a framework to allow all of those different kinds of models to be deployed more easily, more consistently and in a more cost-effective way.”

Sebastian Blanco

SIMULATION

Simulating forward motion at VI-grade’s Zero Prototypes Day

VI-grade doesn’t rest much. New software for its simulations, new simulators to run that software, and new HiL solutions mean there’s always something new happening. And much of this was on hand at the company’s 2025 North American Zero Prototypes Day, held in Novi, Michigan, over the summer.

Earlier this year, VI-grade announced its latest addition, the HexaRev, a new 6-degree-of-freedom motion platform that was designed to outperform traditional hexapods. The simple design uses six motors “essentially connected directly” to the cockpit without ball screws, gears, belts or chains,” according to David Bogema, senior director of product management at VI-grade, “nothing that can create extra noise or vibration or add mechanical latency to the system.” The HexaRev also has a larger overall motion envelope for combined motions than traditional six-degree systems.

“If you combine the HexaRev with the HyperDock, which is our carbon fiber cockpit that we launched last year, this turns it into a [Full Spectrum Dynamic Simulator] simulator, able to simulate that whole range from zero to 20 kilohertz,” he said. “This gives you an incredibly immersive system. It really



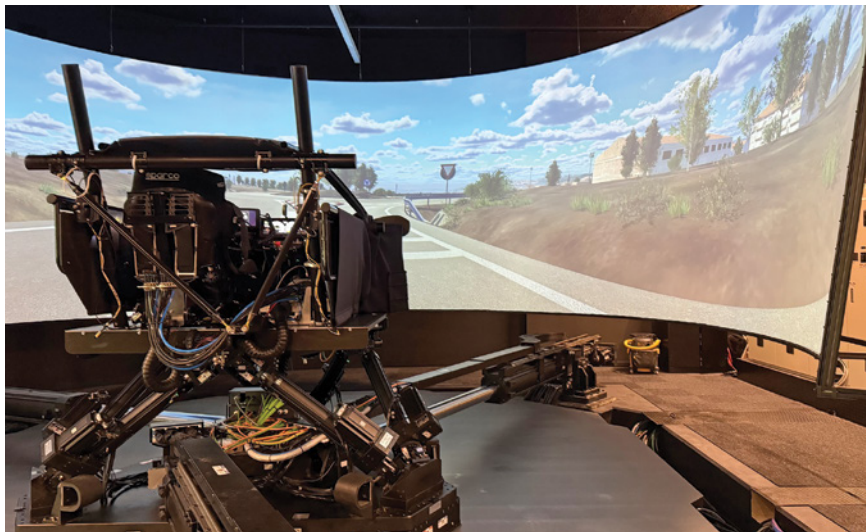
VI-grade’s HexaRev maintains its peak performance across all axes, achieving around 50% better motion-to-footprint efficiency than standard hexapods.

is a watershed moment in terms of motion simulation.”

VI-grade also updated its cloud data service with VI-DataDrive Cloud, which integrates with VI-CarRealTime to deal with the ever-growing mounds of digital data that vehicle testing generates. Previously, the standard way to use VI-CarRealTime was at a workstation, building models, designing tests and running simulations locally. Now, these parameters can be uploaded to the cloud, where simulations can run in parallel and team members can share the data.



“Today, when we’re developing vehicles, they’re more complex than ever, but we have to develop them faster than ever,” said David Bogema, senior director of product management at VI-grade.



VI-grade held ZPD as a regional counterpart to the larger and longer Zero Prototypes Summit held in Udine, Italy in May. The Michigan event was logically focused on bringing new simulation technologies directly to the North American community.

“What this enables you to do is process a lot more data,” Bogema said. “And if you’re doing things like match performance events that take a lot of time, this enables you to do far more than you could ever do on one workstation. It really takes the limits off.

“Today, when we’re developing vehicles, they’re more complex than ever, but we have to develop them faster than ever. We’re developing these vehicles with more and more tests, faster and faster, but we need to be able to get insights into that data, understand that data.”

Helping Honda

One automaker taking advantage of some of these new tools is **Honda**, which uses VI-Grade simulators at R&D multiple locations, including DiM250 and DiM300 simulators and desktop simulators in Germany and Japan, and a COMPACT NVH Simulator at Honda’s Automotive Development Center (ADC) in Ohio. The simulators help Honda produce vehicles faster by improving development efficiency, but the real trick, according to Josh George, principal engineer at ADC, who spoke at ZPS, was finding a sweet spot with the immersion levels that users feel while using the simulator to test for

noise and vibration issues.

“At first, we were trying to incorporate a VR headset to get the person fully immersed into the virtual environment, but we actually found in this case it was a distraction from the NV,” he said. “We do use VI-WorldSim [integrated graphic environment] for some of our evaluations, but in a lot of cases, we actually prefer to use playback of our actual track. Our technical experts are very used to the track and they’re used to the lengths. It’s a familiar scene, and so it puts them in the mindset of being on our actual NV track.”

Along with videos of the real-world track, Honda added a physical start button from a Pilot instead of a simple on-off switch to the unit at ADC. Another added feature is a custom GUI that includes a list of icons of different OEMs so that users can easily change which simulated vehicle is active while moving down the digital road surfaces. Tactile and digital details like this can make a real difference for evaluators who are not as familiar with a specific simulator.

“We try to find ways to avoid wasting our evaluators’ time,” George said. “When they come down, we want them to be able to instantly digest what the simulation is about instead of having to

take a lot of time to explain all of the limitations of the simulator and to set the stage for the evaluation.”

The custom GUI can be created in PowerPoint, which gives evaluators the ability to easily provide the testing team with details about the vehicle to be tested ahead of the scheduled test.

“We essentially create these selectable icons that we can overlay over the image from PowerPoint, so when they touch those it will actually first compile - it uses an Assembly Switcher JavaScript to compile what the simulator is expecting to be able to switch the vehicle - and then that gets passed through a port, UDP sends that, and then VI-NVHSim switches the active car.

“This might look like a very subtle thing, but this has actually completely changed our evaluations,” he said. “We can paint the picture that our evaluators expect to see that they’re used to seeing, and it makes it very easy for them to switch vehicles.”

High-res Wolfsburg

It’s not all serious, accurate sim work at ZPD. While there, I was able to drive around Wolfsburg, Germany - well, a high-resolution digital version, anyway - in a STATIC Simulator set up to mimic a BMW 2 Series. OEMs can use this type of simulator to test HMI tasks - new dashboard layouts, whether the mirrors are in the right spot - as well as NVH, ADAS and AV features, but it doesn’t always have to be totally serious.

All of the demos at ZPD this year used the 2025.2 version of the VI-grade software suite. Among its many updates are more accurate VI-WorldSim Headlights, the company’s headlight simulation module. On the road in virtual Germany, I noticed a VI-grade vanity plate on a Smart ForTwo and was surprised to see a **NAVYA** electric shuttle with **Mcity** branding cruising through fake Wolfsburg. Touches like these suggest that whatever VI-grade is working on, there’s still enough time and energy for engineers to throw a few lighthearted easter eggs into the mix. That’s a good thing.

Sebastian Blanco

SEBASTIAN BLANCO

Engineering EV, charger safety AND SECURITY

COVER STORY

Fireman Access



Renault's Fireman Access port is sealed by a pressure-sensitive disc in the top of a vehicle's high-voltage battery.

From a quick access port to help firefighters fight EV battery fires faster to preventing public charger vandalism, here are some safety developments that haven't made the big headlines.

by Chris Clonts

Most of the news surrounding EV technological development in the past year has been around batteries and charging capacity. But engineers have also been busy working on security and safety issues, from charging stations to finding ways for firefighters to better douse fires. We've rounded up a few of the most notable and novel efforts below.

Renault's fire (or water) in the hole

Earlier this year, **Renault Group** said it is making its Fireman Access system available to the global OEM community via free licensing.

The exclusive system allows emergency responders to put out an EV fire in about the same time they can on an internal combustion vehicle. The crux of the system is an adhesive disc over an opening in the high-voltage battery. Normally, it stays sealed, but when a high-pressure fire hose is attached, the disc dislodges, allowing the cells to be almost immediately flooded with water.

Renault says the system allows a fire to be extinguished in a tenth of the time, and without wasting thousands of

gallons of water, compared to keeping a hose on an EV fire at a distance, the standard practice for many fire departments worldwide.

Renault Group CEO Luca de Meo said in a news release that the system was developed with the cooperation of actual firefighters. "Fireman Access is a practical demonstration of what can be achieved by combining our expertise as a manufacturer with the skills of the men and women who keep us safe every day," he said.

The project was done in conjunction with the United Nations Secretary-General's Special Envoy for Road Safety, Jean Todt.

EVject: Emergency disconnect for EV charging connections

The world of safety in mobility is filled with what-if questions that, despite a seemingly small use case, deserve an answer. One such question: What happens if you need to leave your charging station extremely quickly? Most EV software prevents the vehicle from moving when plugged into a charger. So what happens if you're in a situation in which you can't exit your vehicle to disconnect the charger due to personal safety concerns (for instance, a suspicious person approaching)?

EVject is as simple to use as connecting one end to the charger, the other end to the vehicle and pulling a trigger on the vehicle-end plug. Charging starts normally, but the driver can press the "unlock charge port" button or tap the charging (lightning bolt) icon on the

Engineering EV, charger safety AND SECURITY



A still image from a promotional video that shows water pouring in a Fireman Access port to quench an internal thermal runaway.



Charging can be ended via the touchscreen inside the vehicle. Then, when the driver pulls away from the charger, the charging cable and main part of the plug fall away, leaving only this small piece still attached to the vehicle.

vehicle's touchscreen or app to perform an emergency disconnect and then shift into drive or reverse. This activates the breakaway feature, where EVject splits into two parts at the on-vehicle port, enabling a getaway with only a small piece of the EVject attached to the charge port.

The company says the technology has been tested at high-power outputs (250kW, 480V, and 520 amps) and in extreme conditions up to 115 F (46 C), ensuring reliability. A key feature of the system is thermal sensing that interrupts charging briefly if the plug becomes too hot (defined by Underwriters Labs as more than 85 C (185 F)).

The company cites a 2022 Consumer Reports study in saying that women are twice as likely to cite safety concerns when using EV chargers. Company officials conclude that the technology is crucial



The EVject plug works as a normal charging connection, with the exception of a bottom trigger that engages the system and allows a driver to flee a dangerous situation without exiting the vehicle being charged.

in making public charging stations safer and more user-friendly.

Plugs are available in CCS1 to CCS1, CCS2 to CCS2 and NACS to NACS2 configurations. The system is listed on the company's site for \$299, but the company said that plugs separated in actual emergencies could be replaced at a discount.

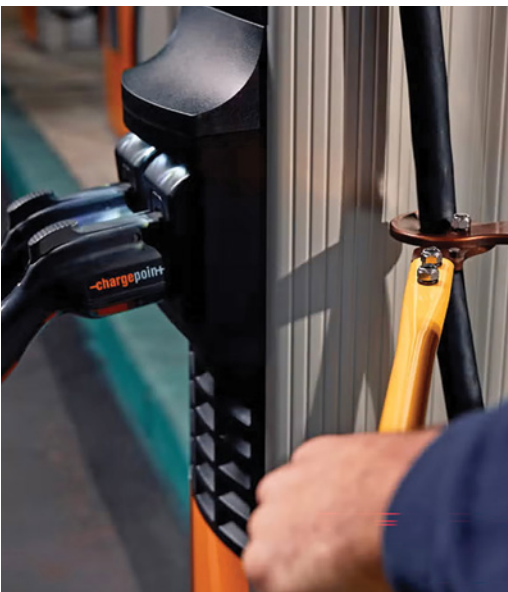
And this technology isn't just for individual drivers. In an interview with EV influencer Kim Java, company founder Kreg Peeler said it's a concern of fleet owners also, a market the company is already in discussions with.

ChargePoint fights vandalism with hardened cable, software

Inoperable public chargers are one of the biggest problems faced by EV drivers and feared by potential EV buyers. A study by **ChargerHelp**, the EV charger maintenance company, reported a dismal uptime of 73% late last year.

ChargePoint, operator of the nation's largest number of public charging points (**Tesla** leads in fast chargers) announced a two-pronged approach to tackle the problem earlier this year.

The biggest problem – and a most unsightly PR problem – is chargers that have been vandalized, with



ChargePoint's new cables, despite being hardened against attempts to cut them, keep the same flexibility as previous cables, meaning the end user experience is the same.

cables cut clean through, sometimes for the valuable metal within. In announcing that it would start deploying hardened cut-resistant cabling, ChargePoint CEO Rick Wilmer said the company was not a "victim of vandalism." Rather, he said, "we are responsible for solving it, not only for our customers but for the industry. We are sharing the technology to combat vandalism in the most aggressive way possible with the aim to eliminate charger reliability as a hindrance to EV adoption."

The cut-resistant cables are protected by what the company calls novel materials like hardened steel and use-specific polymers, likened to bullet-resistant material. They are said to keep the flexibility of original cables despite the added security.

In addition to deploying cables at its own charging stations, ChargePoint said it would sell cables to other companies as part of its effort to improve the industry's overall uptime.

The company also released ChargePoint Protect, security software that integrates with components already on public chargers, such as

speakers and video screens. The software, available for free, detects cable tampering in real time and works to deter vandals and thieves. It also can alert operators via SMS and email to ensure faster intervention.

Tesla protects cables with a ***surprise*** for vandals

ChargePoint isn't alone in looking for ways to secure its equipment. In early spring, Electrek and other outlets reported two

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The software, available for free, detects cable tampering in real time and works to deter vandals and thieves. It also can alert operators via SMS and email to ensure faster intervention.



In an ongoing test, Tesla is having its wire bundles (that are eventually coated) engraved as a signal to scrapyards that they should not accept the presumably stolen material.

novel methods EV giant Tesla was testing to secure its chargers and superchargers.

One, in an amusing (unless you're a vandal) method inspired by those dye packs some banks deploy during robbery attempts, uses cable sheathing that contains blue dye under pressure. The technology, called DyeDefender from a company called **CatStrap** that originally specialized in protecting catalytic converters, ensures that anyone cutting through the cabling is sprayed with the semipermanent dye, making for easy identification of suspects.

In another, more subtle effort, cables made for Tesla have "property of Tesla Motors" engraved on the wire bundles. Max de Zegher, Tesla's charging director, said on X that it would indicate to scrap-



In this still from a DyeDefender demonstration video, a "vandal" is sprayed with the blue dye after cutting into the pressurized outer cable.

yards that they should not buy scavenged products and notify the company. "It's a scalable, cost-effective solution that doesn't impact service operations & customer experience," he said. ■

FROM LEFT: TESLA; DYEDDEFENDER



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Electronic stability control builds the foundation for **SAFER ROADS**



How a mechanically simple idea has kept cars stable for decades, and why it can still evolve for an autonomous future.

by Rich Nesbitt

Since debuting in 1995, Bosch's electronic stability program (ESP) has become one of the most essential safety features in modern vehicles. It's now a standard on nearly every new car sold in America and has been deployed in over 350 million vehicles worldwide.

ESP is more than just legacy tech. It's the foundation behind advanced driver assistance, motion control and a more automated future.

Expanding the capabilities of active safety

ESP builds on another innovation, anti-lock braking systems (ABS), which Bosch first brought to market in 1978. While ABS prevents wheel lockup during slip scenarios while braking, ESP goes further. It combines ABS, traction control, and yaw sensors to help keep vehicles on their intended path under dynamic driving conditions. It does so by selectively applying brake pressure to individual wheels.

Mechanically, ESP systems consist of electric motors, reciprocating pumps, and electronically actuated valves. These core components have remained largely consistent over the past 30 years. What has changed significantly is the surrounding electronics, computing power and, most notably, the software that enables modern features.

Software-defined control and scalable innovation

ESP was one of the first automotive systems to demonstrate how software could extend hardware capabilities. Features such as hill-hold assist, trailer sway mitigation and multiple drive modes are software

enhancements that run on top of the original system architecture. Many of these capabilities require no changes to the core hardware.

To support this flexibility, Vehicle Dynamics Control 2.0, a modular software platform that can operate within the ESP unit or be distributed across zonal and centralized computing architectures, was developed. This portability enables automakers to tailor ESP deployment to a wide range of electronic vehicle architectures, whether they are distributed, centralized, or hybrid.

In parallel, ESP has advanced to meet increasing demands for processing power, storage and responsiveness. In late 2024, Bosch began producing the 10th-generation ESP units at its Charleston, South Carolina facility, incorporating improvements in efficiency, dynamic response and manufacturability.

A system built to scale: from two-wheelers to Class 7 trucks

ESP's value extends beyond light-duty passenger cars. In North America, where high-performance trucks, heavy-duty pickups and commercial vehicles are prevalent, ESP variants can address the specific demands of larger platforms. These systems are capable of supporting up to Class 7 trucks, the upper boundary of hydraulic brake systems before they transition to air brakes in Class 8 vehicles.

These use cases present unique challenges, such as supporting variable load states and high brake fluid flow rates. ESP's evolution addresses these through hardware adaptations, such as larger component sizing fit to the larger brake sizes, and software calibration to maintain control under wide dynamic ranges. Conversely, ESP is also being applied to smaller platforms, including motorcycles and ABS on high-speed e-bikes.

Support for commercial fleets

ESP has proven particularly valuable in the commercial vehicle sector, where operators face wide variations in load, terrain and driver training.

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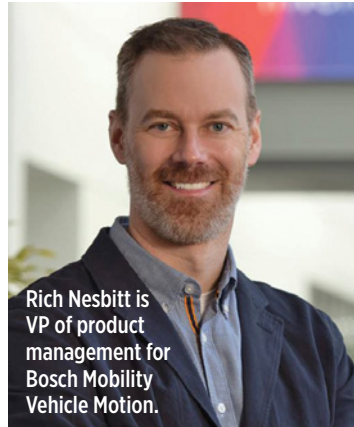
Many fleet vehicles operate in Classes 2B through 7, a segment where ESP can improve stability, stopping performance and vehicle control, especially under dynamic weight conditions or during emergency maneuvers. ESP can help keep commercial vehicles stable, predictable, and out of the repair bay even when cargo loads vary or drivers are less experienced.

The technology also has implications for insurance and regulatory environments, as fleet operators increasingly focus on risk mitigation, uptime, and safety metrics. By applying ESP learnings from high-volume passenger car platforms, ESP can be efficiently scaled for commercial applications. That means enhanced safety, reduced insurance risks, and strong compliance on key regulatory topics like AEB.

Application-driven development

ESP has undergone continual validation and refinement through real-world and regulatory testing. In the United States, the “fishhook” maneuver became a standard used in the development of Federal Motor Vehicle Safety Standard (FMVSS) No. 126, which mandated Electronic Stability Control (ESC) on light vehicles starting in 2012.

Beyond regulatory compliance, ESP applications have been developed tailored for off-road use, recreational towing and trailering, as well as performance vehicles. Off-road drive modes, for example, adjust ESP calibration to maintain traction on loose terrain, improve steering re-



Rich Nesbitt is VP of product management for Bosch Mobility Vehicle Motion.

As vehicle platforms continue to evolve toward higher levels of automation, ESP plays a foundational role.

sponse and enhance driver confidence. In trailering scenarios, ESP helps mitigate trailer sway through software-based detection and brake control, improving safety for users who may not have advanced towing experience.

These developments are often driven by the needs of OEM partners and reflect a broader push to integrate intelligent, adaptable motion control across various platforms and use cases.

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Electronic stability control builds the foundation for **SAFER ROADS**



ESP can be combined with an electromechanical brake booster to provide the braking system redundancy for automated vehicles.

Positioning for the future: automation and brake-by-wire

As vehicle platforms continue to evolve toward higher levels of automation, ESP plays a foundational role. Whether supporting Level 2 driver assistance or fully autonomous shuttle operations, vehicles will continue to require robust, redundant brake control systems capable of operating without direct driver input.

One solution is an electric brake booster system, like Bosch's iBooster, that works in tandem with the ESP

unit to provide pressure buildup and redundancy. This architecture supports brake-by-wire functionality while maintaining the safety and validation benefits of legacy systems.

Vehicle-level software is also expected to become more distributed across multiple domains, creating opportunities to segment control logic between central processors and local actuators. ESP software has been designed with this flexibility in mind, enabling OEMs to allocate features based on architecture constraints while preserving core system performance.

A platform that continues to deliver

Since its introduction, ESP has grown from a niche safety innovation to a global standard. It continues to serve as the underlying control for a wide variety of features, from everyday driving stability to high-performance agility and automated braking. It keeps families safe, fleets moving, and future tech grounded in something we all need: safety and control.

Its evolution has been defined not only by technological advances but also by its adaptability across platforms, use cases and regions. As the industry moves toward electrification, automation, and centralized architectures, ESP remains a critical enabler of safe, scalable vehicle motion control. ■

Rich Nesbitt is VP of product management for Bosch Mobility Vehicle Motion and wrote this article for SAE Media.

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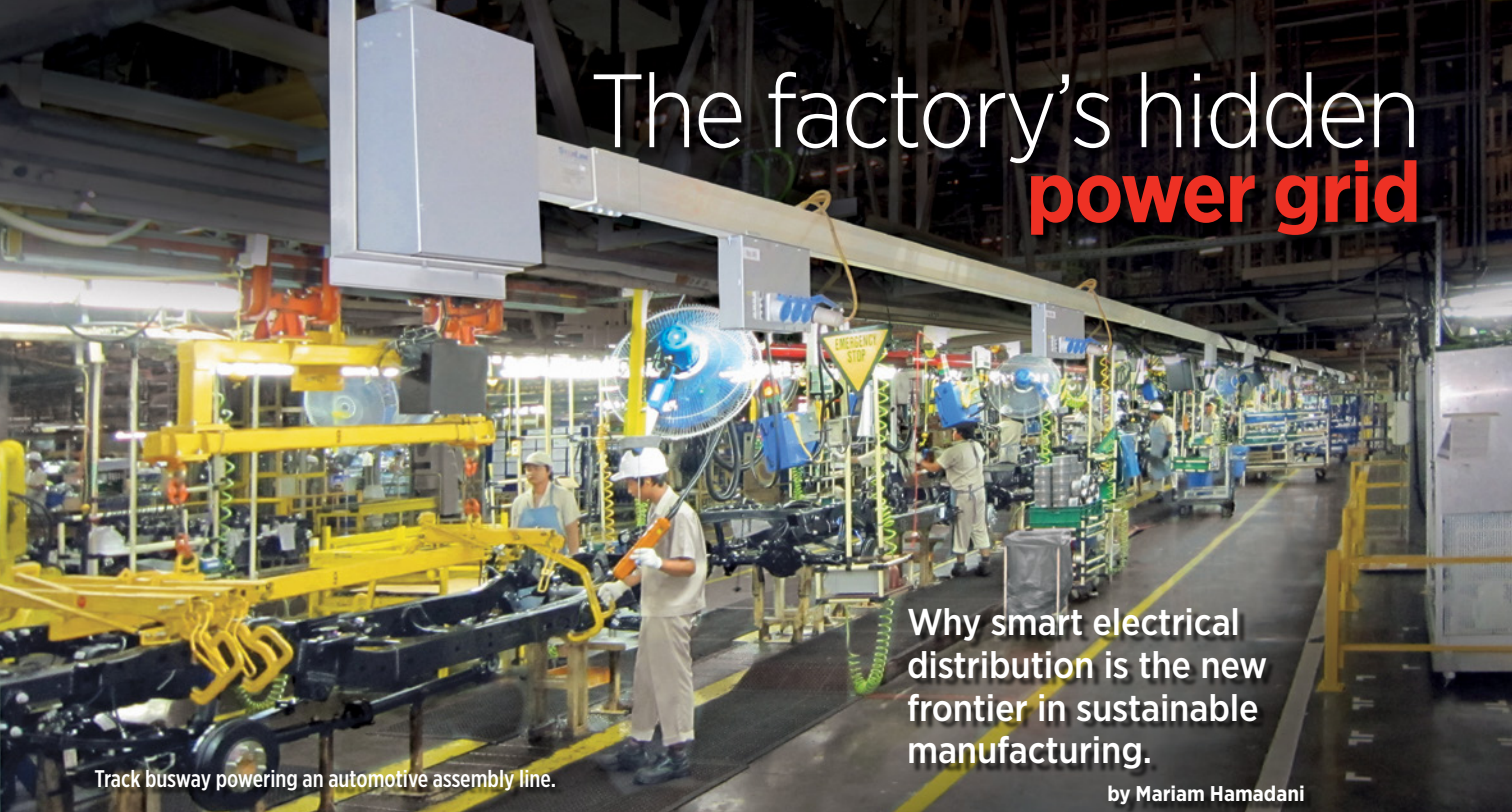


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The factory's hidden power grid



Track busway powering an automotive assembly line.

Why smart electrical distribution is the new frontier in sustainable manufacturing.

by Mariam Hamadani

From transitioning to renewable energy, embracing the circular economy and pursuing carbon offsets, today's automakers are actively working to become more sustainable. Many OEMs have big goals to become fully carbon-neutral by 2050. Some believe they can get there even earlier.

But look past the cars and sources of energy right into the factories in which the vehicles of today and tomorrow are born and focus on a key question: how can carmakers make significant strides inside their plants to cut waste and improve sustainability?

To find real, lasting savings, automotive leaders must look to their plant's electrical efficiency. That means examining the power distribution technology they use to deliver electrical power to equipment in different areas – from large, robotic assembly lines and conveyor systems to smaller tooling stations and HVAC/environmental systems.

It's not just about using energy more efficiently. Rather, it's about using technology that provides a long-term sustainability advantage by reducing waste and offering greater durability and reusability than conventional power distribution methods. In the big picture, it's about setting automakers up for long-term efficiency and sustainability as they streamline operations over time.

Why do modern auto plants need more power?

The way vehicles are manufactured today is changing fast – and automotive plants are hard-pressed to keep up. From increased use of precision robotics and AI-driven automation to growing global consumer demand for EVs, today's factories need more electricity than ever before.

Factories that once only required 100-amp or 225-amp systems now need vastly more powerful ones, up to 1,000 or 1,200 amps. Reasons for this rapid increase include:

- Growth in the capacity of lithium-ion cell manufacturing, keeping pace with the rise in global EV sales.
- OEMs continue to embed more “intelligent” technology in all types of vehicles, from Level 2 ADAS technology to modern infotainment systems.

- Increasing use of AI and automation requires some factories to host their own data centers on-site.

In addition to the growth in battery manufacturing and facilities with on-site data centers, there are several other drivers of heavy upgrades to maximum amperage. For example, in high-density welding bays, dozens of robotic welding arms might run simultaneously. Even if individual mid-frequency direct current (MFDC) welders are efficient, an entire cell of them can have an aggregated energy demand that needs enhanced power distribution capabilities to support it.

Many OEMs are also producing different types of vehicle models on the same line, from internal combustion engine vehicles to hybrids and EVs. This requires modular manufacturing cells that can be reconfigured quickly without rewiring or shutting down power. And that is pushing automakers to seek more flexible power distribution backbones, using systems that allow them to reposition a circuit without shutting down power or rewiring.

When a manufacturing line changes, the existing conduit or pipe and wire is often a headache to remove and cannot be reused. This creates material waste and operational inefficiencies while hampering the industry's efforts to become more sustainable.

Smarter power distribution design for increased sustainability and performance

Open channel track busway, such as Starline Track Busway, is a power distribution system that uses modular plug-in units which can be removed and positioned anywhere along the track without shutting off

STARLINE



Track busway installed ahead of factory equipment installation.

power to the system. Using a 90-degree turn-and-lock mechanism, each plug-in unit creates a secure electrical connection directly into embedded conductors. With overhead, wall-mount and rack-mounting options, the system's underlying technology supports flexible configurations and layouts, offering high-amp segments up to 1,200 amps. Automakers can move and rearrange power when and where they need it, eliminating the need for costly rewiring.

When manufacturers choose a smarter power system, the benefits add up quickly. From a sustainability perspective, an open channel track busway system is built to last and reduce waste. The technology is highly durable, made from aluminum and copper. In real-world automotive applications, installations have been in place for over 20 years, still with complete functionality. Unlike conduit, track busway technology is modular and reusable. As factory layouts change, it can be moved and reconfigured, dramatically cutting down on material waste over the plant's lifecycle.

In addition to its sustainable design and longevity, track busway technology provides several other benefits. Unlike conduit, which is heat-prone and labor-intensive, track busway facilitates continuous access to power with minimized heat loss through reduced electrical resistance. Its open channel design also eliminates the need for supplemental cooling, reducing HVAC loads. By helping automakers utilize energy more efficiently and reduce the load placed on adjacent systems, track busway can provide automakers with significant sustainability benefits right at the foundational layer of their operations.



A Starline Track Busway electrical distribution system in use at a Winar Connection facility.

Making wasted energy visible

Track busway systems also enable greater electrical system efficiency and load balancing through real-time measurement and monitoring. Facility managers can track power at two levels:

- At the end feed, where power enters the busway system
- At the circuit level, directly in the individual plug-in unit

The resulting data can help managers see exactly where energy is going. Operators can monitor machine load profiles and use data to identify abnormal operations. Power data can also be used for load balancing across the factory to prevent waste. With minimized voltage loss, even over hundreds of feet, track busway is a key resource for maximizing power efficiency.

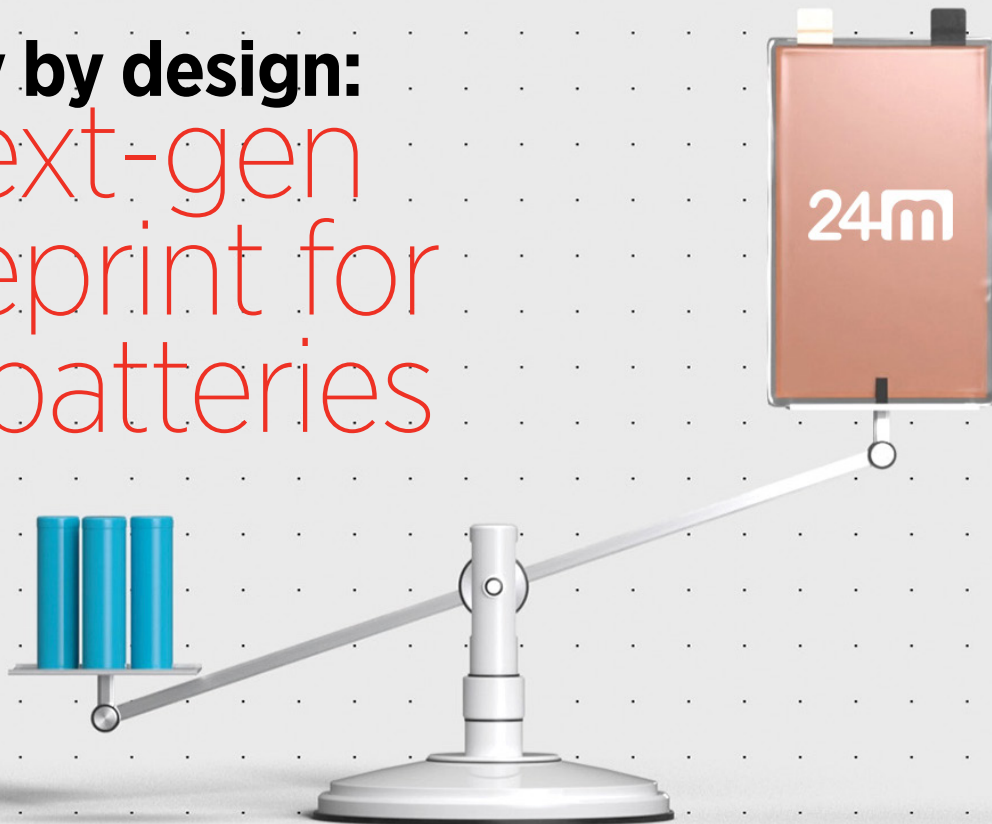
When selecting a track busway product, automakers should also consider the existence of PEPs (product environmental profiles). These documents provide verified transparency into the environmental impact of the product across its lifecycle. Achieving greater sustainability is not just about selecting products that improve operations, but also about selecting products that can help reduce Scope 3 emissions, which are crucial in meeting ambitious carbon-neutral targets. Aligning with an equipment manufacturer with a clear plan for ever-increasing sustainability (e.g., one that aims for net zero by 2050, with a 90% reduction in GHG emissions compared to 2022) ensures that automakers not only get high-performing equipment, but a partner that understands their needs.

The future of factory power

As car technology continues to evolve towards sustainability, the factories that build these new vehicles must keep pace. The choice of a power distribution system is a key decision affecting operational efficiency and sustainability. A facility implementing a track busway not only gains modular flexibility, but also reduces waste and improves operational efficiency. ■

Mariam Hamadani is global automotive account manager at Starline and wrote this article for SAE Media.

Safety by design: a next-gen blueprint for EV batteries



A complete battery redesign results in a lighter, safer, more efficient, and more adaptable battery.

The EV industry can – and should – stop pushing decades-old battery architecture well past its limits.

by Naoki Ota

For more than three decades, the fundamental design of lithium-ion batteries has remained largely unchanged, tracing back to Sony's original design in 1991 for small portable electronics. While impressive advancements have been made in materials, chemistry, and manufacturing efficiencies, the core design has remained the same. This legacy design, initially developed for small, low-voltage, low-energy-density applications, has now become a significant bottleneck for the automotive industry and the future of electric vehicles.

Imagine only updating the apps on your phone without ever updating the operating system. No matter how modern the apps become, the system cannot keep up with new demands. At some point, performance stalls and the system hits a wall. This is the situation the EV industry faces today. We're pushing decades-old battery architecture well past its limits.

By just optimizing around the edges, we're building on a flawed foundation. The conventional battery cell and pack architectures were never designed for today's EV demands, and its limitations are clear: persistent material waste, complex thermal management, heightened safety risks, and rigid formatting that constrains manufacturability.

The trade-off trap

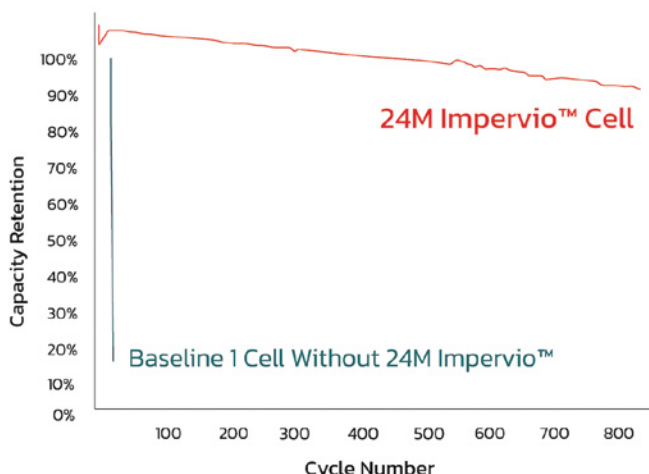
As EV adoption accelerates, these battery limitations translate directly into costly trade-offs for automakers. With pressure to deliver longer range, faster charging, and higher performance, engineers are forced to trade one performance metric for another. For instance, striving for higher energy density often comes at the expense of safety, while pushing for lower costs might compromise performance or quality control.

This approach, despite yielding some significant improvements since Sony's original products in the early 1990s, is now facing diminishing returns.

In the current EV landscape and given global competition, battery fire safety may be the most dangerous trade-off. Range and fast charging requirements have pushed batteries to their performance limits; however, these gains often come at the expense of safety. With projections of 250 million EVs on the road by 2030, thermal incidents are expected to rise unless battery technologies become inherently safer. Markets have already seen a 33% surge in EV thermal incidents, underscoring an upward trend in both safety risks and related expenses.

In 2025, EV battery-related incidents made headlines. One incident of a cargo ship blaze that destroyed 800 EVs in the Pacific was linked directly to thermal runaway. Widespread battery-related EV and hybrid recalls highlight the scale of the problem. Each recall can cost automakers up to \$1 billion per model line, creating massive financial exposure as EV markets scale globally. Combined, these incidents spread fear, hinder adoption, and reveal the steep financial cost of faulty batteries.

Battery experts now classify today's EV batteries as a "Severity 10" risk, the highest level on the Design Failure Mode and Effects Analysis (DFMEA) automotive safety scale, where failure poses an immediate and severe risk of injury or fatality. This reflects an industry



Internal comparison test of identical NMC/graphite cells with and without 24M Impervio demonstrates the separator's significant safety advantages.

consensus that current lithium-ion designs are no longer sufficient, and that incremental process adjustments will not solve the problem. To genuinely break free from this cycle of fires, recalls, and eroding consumer trust, the industry must confront the root cause: the outdated architecture of the battery itself. What's needed is not more patches, but a design that embeds safety into the cell from the start.

The case for a ground-up redesign

EV batteries need a redesign that enables safety, cost, and performance to advance simultaneously, rather than trading one off against another. This means embedding safety directly into the cell architecture and streamlining manufacturing processes to reduce costs. This approach unlocks innovation potential, allowing for entirely new materials, cell formats, and production methods that were previously impossible with conventional designs.

One strategy is to focus on safety and flexibility at both the electrode and pack level. One of the primary causes of internal short circuits is the growth of dendrites, which can form during overcharging or regular wear and tear. Dendrites can pierce internal components, triggering a short circuit that can lead to fire. At 24M, we've developed a functional battery separator that transforms what was once a passive thin polymer into an active safety component. Our 24M Impervio technology suppresses dendrite growth in the electrolyte and monitors the cell's state-of-health. This enables it to detect internal shorts, even in overcharged batteries, before they escalate into thermal runaway. Built on conventional separator materials, 24M Impervio integrates directly into existing cells, delivering a new layer of safety from inside the battery itself.

But solving for safety alone isn't enough. To fully unlock next-generation EV batteries, safety must be paired with better design flexibility. Electrodes that are integrated directly into the pack eliminate the need for traditional cells and modules and, at 24M, enable up to 50% more range and a more flexible design for a streamlined manufacturing process.

We need more innovations like these that move the industry beyond incremental tweaks and provide a fundamentally safer, more efficient, and more adaptable battery blueprint.

By embedding safety and performance into the architecture itself, we can deliver safer EV batteries that restore consumer trust, lower costs, and accelerate mass adoption worldwide.

Stop optimizing the past, start building the future

The battery industry stands at an undeniable inflection point. Legacy designs can no longer keep up. They weren't meant to power the current EV era and consumer demands. The path forward is not more patches, but a proven battery redesign rooted in safety and flexibility.

The next decade of EV growth will depend on solving the battery safety problem. Regulators, automakers, and consumers alike need confidence that EVs won't trade performance gains for fire risk. At the same time, the industry must ensure resilient supply chains, scalable manufacturing, and affordable recycling solutions.

By abandoning outdated thinking and building a new foundation for energy storage, we can deliver safer, more scalable, and more flexible batteries than ever before. This new approach is necessary to enable a full transition to EVs with the implementation of new battery architectures. ■

Naoki Ota is president & CEO of 24M Technologies and wrote this article for SAE Media.



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SAE BOOKS:

Vehicle fire safety with Erbis Biscarri

Author turns classroom quest into a tome for anyone who wants to engineer safer cars.

by Sebastian Blanco

A seasoned engineer with a multi-discipline background in electronics, manufacturing systems, and forensic analysis, Erbis Biscarri brought decades of experience to the topic of automotive safety in his latest work. Biscarri's book, *Fires in Conventional and Electrified Vehicles: Theory, Prevention, and Analysis*, published by SAE International, offers a comprehensive guide to one of the industry's most pressing challenges: vehicle fire safety.

In addition to technical analysis, Biscarri said, the book helps clarify common misconceptions, especially those surrounding electric vehicle fires, by grounding the discussion in documented incident data and established technological principles.

"This book is both technical and investigative," he told SAE Media. "It's designed to help engineers, students, safety and forensic professionals understand the full spectrum of fire-related mechanisms in vehicles, whether powered by combustion engines or electrified drivetrains."

Biscarri's academic foundation began in electronics engineering at the University of São Paulo, followed by a master's in manufacturing systems engineering from the University of Michigan. His career spans product design, development, and forensic analysis, with roles at **Ford Electronics**, **Visteon**, **Johnson Controls**, and **Peugeot-Citroën**. He also contributes to forensic engineering efforts for Brazil's judiciary system and currently teaches SAE courses on fire safety and investigation, bridging theory with practical applications.

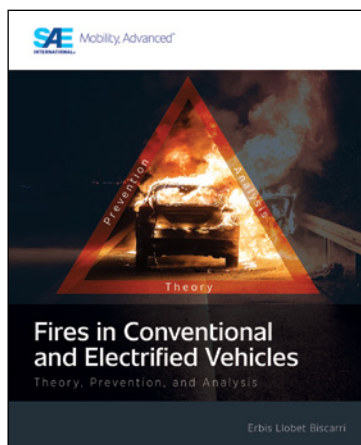
The idea for the book emerged from his teaching experience. "I realized there wasn't a single textbook that covered everything I needed to teach," he said. "So, when SAE offered me the opportunity to write one, I knew it was time to create a resource that could truly support the current and next generation of engineers."

The book is structured into three distinct sections:

- **Theory:** the foundation for understanding fire mechanisms and dynamics in vehicles



Erbis Biscarri, author of *Fires in Conventional and Electrified Vehicles*, published by SAE International.



- **Prevention:** strategies to mitigate fire risks across various vehicle types
- **Analysis:** presenting robust investigative methodologies and real-world case studies

Together, these sections explore the causes and consequences of vehicle fires, from thermal runaway in lithium-ion batteries to fuel system failures in internal combustion engines. The book incorporates recent fire statistics and large-scale incidents to highlight growing concerns around vehicle fire safety. It also examines investigative techniques, regulatory frameworks, and prevention strategies, supported by data-driven analysis and field experience.

Importantly, Biscarri embraces complexity. Some case studies in the book end without a definitive cause, an intentional reflection of the ambiguities often faced by forensic engineers.

"In the real world, not every fire incident has its root cause clearly identified," he said. "That's why it's essential to master a wide range of investigative approaches and recognize the eventual limitations of available evidence."

Biscarri said early readers of the text have praised the book's clarity and depth, noting its value as a practical resource for professionals involved in vehicle fire analysis. Biscarri said the feedback proved he had hit his target of distilling decades of hands-on experience into an accessible and authoritative engineering education text that's rooted in practicality.

"Theory is important, but it's only part of the picture," he said. "What matters most is how we apply that theory to real-life challenges: how we design safer systems, respond to incidents, and continuously improve our understanding."

Beyond technical expertise, Biscarri said he advocates for interdisciplinary collaboration in automotive safety. He emphasizes the need for cooperation between engineers, regulators, and emergency responders, especially as vehicles become more complex and electrified.

"Safety isn't just an engineering problem, it's a societal one," he said. "We need to think holistically about how we protect people and property."

Biscarri hopes to spark deeper conversation about fire safety in the EV age with *Fires in Conventional and Electrified Vehicles*, available at <https://www.sae.org/publications/books/content/r-567/>.

"This book is for anyone who wants to understand the risks and responsibilities that come with building and operating modern vehicles," he said. "It's about equipping people with the knowledge they need to make informed decisions and, ultimately, to save lives." ■

Hyundai Palisade: A luxury three-row SUV without the price tag you'd expect

Years ago, Hyundai hosted a Palisade drive program for journalists consisting mostly of driving on a gravel road for a few hours. It was weird, and many a journalist told them so. It may not be a direct reaction to that feedback, but on a recent drive program of the new 2026 Palisade, Hyundai made sure that we drove the well-equipped SUV on regular, albeit twisty roads in the Napa region of Northern California. The auto-maker also took us off-road again. This time, with boulders.

Hyundai's Palisade has long found itself in the shadow of Kia's Telluride. Built on the same platform, design-wise, the Kia always tended to turn more heads. With the 2026 upgrade, the Palisade is coming into its own looks-wise, while being outfitted with upgrades that keep the SUV punching above its weight class.

Road Tripping

The Hyundai Palisade is powered by a 3.6-L V6 that produces 287 hp (214 kW) and 260 lb-ft (353 Nm). It's an adequate powerplant for a vehicle this size. It's not overly quick and doesn't feel sluggish while merging onto the highway or on the winding backroads. Braking felt more than capable during



Hyundai's updated Palisade gets a design makeover.

downhill portions of the drive, and accelerating out of corners was smooth without having to shove the accelerator to the floor.

Steering can feel a bit detached with just a little too much play. Jumping into sport mode does tighten up the steering a bit, but it's unlikely the average Palisade owner will notice or care. The bit of wiggle room creates a sense of smooth control and doesn't deter from Hyundai's ultimate goal, which is to make this vehicle feel more expensive than its starting sticker price of \$38,935

(destination fee: \$1,495). To wit: in Napa, Hyundai has us drive the AWD, top-of-the-line Caligraphy model with a starting price of \$56,060 (destination fee: \$1,495).

All gas-powered trim levels are paired with an 8-speed Shifttronic automatic transmission paired with a two-chamber torque converter. A welcome addition to any vehicle in an industry that increasingly uses CVTs. And everything comes together with a suspension that reduces some of road bumps typical for a hilly region to tiny blips that are barely noticeable while driving or riding. We found the Palisade to be a delightful driving experience ready for road trips across the state or just across town.

It's the inside that counts

The exterior design of the Palisade is an important upgrade, allowing the vehicle to exude more character and help it break from the growing pack of mid-sized three-row SUVs. But given how much time you spend in a vehicle, it's worth noting how Hyundai has thrown a ton of tiny upgrades to the interior that result in a comfortable, dare I say luxurious, experience. All the materials felt like they were made of higher-quality materials than are commonly found in a SUV under \$60,000.

The seats were supportive while cozy enough for a multi-hour road trip.



The Palisade's dashboard has what Hyundai calls "intuitive" controls.

Depending on the trim level, both the first and second rows offer one-button “relaxation” setting that moves the seat all the way back and reclines it. More importantly, the second and third rows can be adjusted forward and back offering up a mix of seating for passengers of various heights. For those of us over six-feet tall, comfortable third rows in mid-sized SUVs seem more a marketing myth than a reality. While sitting all the way in the back for hours on end would be uncomfortable, if seated behind a shorter person, the third-row is fine for a jaunt across town. What’s impressive is that all three rows can be outfitted with heated seats. No longer will anyone feel left without a warm backside during the cold winter months. For those hauling more than humans, the cargo room behind the third row is 19.1 ft³. Fold down that row and it increases to 46.3 ft³. Finally, with the second and third rows folded down, the space jumps to 86.7 ft³.

The dashboard has been outfitted with what Hyundai calls “intuitive” controls for the climate and media controls. In truth, Hyundai just put some buttons and knobs back in the car, but this is a welcome return to physical controls.

The infotainment system didn’t display any noticeable latency. Hyundai errs on the side of not going too overboard with its infotainment system, a strategy that works in their favor. The

The XRT Pro is more capable than is really needed.



system is easy to use without having to figure out anything new. **Google** Places has been integrated for more detailed information about a location.

One bonus that’s sure to make your insurance carrier happy is the addition of front- and rear-facing dash cams. The native cam saves data to an SD that’s stored in the glove compartment. The footage from the day’s drive was clear and crisp with details about the date, speed, brake and turn signal usage.

Off the beaten path

In the middle of the drive, Hyundai had us step out of the Caligraphy-trim Palisades

and into the XRT Pro, which starts at \$49,370 (destination fee: \$1,495). The automaker set up an off-road course along a dirt trail that was awkwardly narrow and far more complex than, really, any Palisade driver will encounter.

The XRT handily conquered soft dirt uphill climb, traversed over moguls, and slowly crawled over an area of small boulders (about the size of basketballs). Again, it’s extremely unlikely anyone is going to do this level of offroading. Those buying the XRT just want the confidence that if get stuck in a snowstorm, on a muddy trail, or have to climb up a slightly technical dirt road, they can.

Up next, a battery

The 2026 Palisade throws a barrage of small updates to create a vehicle that should be cross-shopped with luxury mid-sized three-row SUVs. If the combined 20 or 21 mpg (FWD and AWD, respectively) fuel economy ratings seems like a deal-breaker, a hybrid version will be available this fall. It’ll likely be a bit quicker off the line while saving money at the pump. We’ll know more once we get some time behind the wheel.

Until then, the 2026 Palisade is an exceptional upgrade to an already impressive vehicle that can haul all of your friends in style. Unless they’re all basketball players.

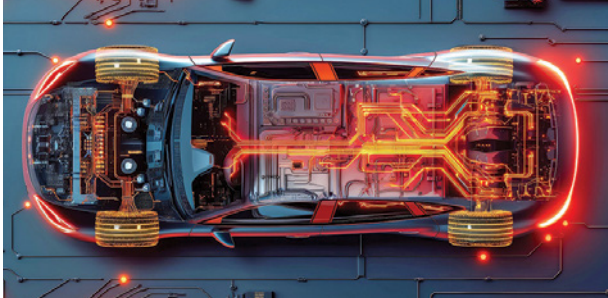
Roberto Baldwin

Hyundai’s XRT Pro will bring additional comfort to those looking for off-road capabilities.



SPOTLIGHT: EV THERMAL MANAGEMENT

Silicon carbide MOSFETs



onsemi (Scottsdale, Arizona) announced an expanded collaboration with **Schaeffler** (Fort Mill, South Carolina) that leverages onsemi's EliteSiC product line of silicon carbide MOSFETs. Onsemi's technology will power the Schaeffler traction inverter for a global automaker's plug-in hybrid platform. onsemi claims that its EliteSiC technology offers significantly lower conduction losses and superior short-circuit robustness, enabling a compact, thermally efficient inverter design that enhances overall system performance. This silicon carbide-based solution offers low on-state resistance to provide high peak power compared to other SiC solutions in its class. These benefits allow Schaeffler to deliver a traction inverter system that achieves measurable benefits to the end customer.

<https://www.onsemi.com>

SPOTLIGHT: PLASTICS AND COMPOSITES

Molding platforms

SABIC (Riyadh, Saudi Arabia) introduced **MEGAMOLDING**, a molding platform designed to enable the manufacturability of large thermoplastic parts across multiple industries. SABIC states that MEGAMOLDING can enable faster, more cost-effective and more sustainable manufacturing solutions compared to traditional metal and thermoset material approaches. The platform's benefits include cost and process efficiency by using competitive tooling, consolidating parts and simplifying manufacturing, post-processing and assembly steps. MEGAMOLDING is reportedly suited for a range of automotive uses such as battery enclosures, heavy truck parts (hoods, roofs, body panels) and large structural components.

<https://www.sabic.com>



Data processing platforms

VI-grade (Udine, Italy) launched **VI-DataDrive Cloud**, a cloud-based simulation and data processing platform designed to reduce run times for complex vehicle models. VI-DataDrive Cloud addresses the limitations of local simulation by leveraging scalable cloud infrastructure. The system runs multiple VI-CarRealTime instances in parallel, accelerating max performance simulations, DOEs and model diagnostics. This makes it possible to execute studies that would otherwise be time-prohibitive, particularly for advanced vehicle dynamics development and system-level investigations. VI-DataDrive Cloud also features a customizable post-processing environment where results can be visualized online, downloaded for local analysis and easily shared across engineering teams.

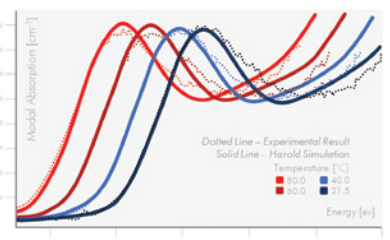
<https://www.vi-grade.com>



Simulation tools

Photon Design (Oxford, United Kingdom) announced that its quantum dot module for its **HAROLD** laser simulation tool is now available as a release candidate for customer evaluation. The HAROLD module reportedly enables engineers to model a quantum dot laser's epitaxy structure, including dot size and distribution. Its eight-band K.P.-based modeler predicts laser gain and absorption spectra, reliably matching the results of beta sample quantum dot lasers in recent field tests. Photon states that QD lasers operate reliably at higher temperatures than existing lasers, with superior modulation and data transmission performance, and that the heat and power savings provide practical manufacturing benefits.

<https://photon.com>



Spectrum analyzer

Yokogawa's

(Calgary,
Alberta)

AQ6370E

optical spec-
trum ana-

lyzer provides a wavelength range of 600 nm to 1700 nm, supported by a typical wavelength measurement accuracy of ± 0.015 nm and 0.02 nm resolution. For detailed analysis of VECSEL emissions, the AQ6370E features a high-resolution HCDR (High Close-in Dynamic Range) mode that sharpens the spectrum around the peak and provides a clearer visual representation of the side modes than possible in standard mode. Low-power optical signals can be measured accurately and quickly, without any need to use averaging over many measurements.

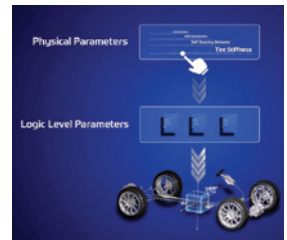
<https://www.yokogawa.com>



Chassis calibration software

ZF's (Zuffenhausen, Germany) cubiX software supports the complex calibration of individual actuators during the vehicle development process. Designed as an intuitive tool for OEMs, cubiX Tuner automatically calculates the interdependencies between actuators. An ECU can now be configured with the manufacturer's unique "brand DNA" in just a few clicks. This saves time, costs and effort when developing new vehicle models. Chassis actuators ensure that a car accelerates safely, brakes reliably and stays stable through corners. With cubiX, ZF offers a solution that seamlessly connects individual actuators to deliver optimal control interventions while driving.

<https://www.zf.com>



Hall effect sensors

NewTek Sensor Solutions (Pennsauken, New Jersey)

launched the RVD Series Hall Effect Angle Sensors designed to meet the high demands of environments where precision, reliability and durability are critical. Utilizing Hall effect technology, these sensors provide exceptional rotational position (angle) measurement, offering high performance and dependability in the harshest conditions. The non-contact design of these sensors measures rotational position without mechanical moving parts that can wear out over time. This unique feature extends the angle sensor's operational life and ensures long-term measurement stability. In industrial settings where sensor downtime can be costly, this durability translates into long-term cost savings.

<https://www.newteksensors.com>



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MOSFET family

Anric Technologies (Billerica, Massachusetts) unveiled a new

MOSFET family designed for supercaps rated at 3V or higher. Anric claims this chip provides precise voltage and leakage current balancing and that this MOSFET consumes virtually no power while preventing catastrophic failures in series-connected supercaps. It also reportedly enables stacking of four 3V supercapacitors to meet 12V power requirements. This makes it suitable for utility boxes, backup power systems, industrial automation, renewable energy and consumer electronics. Anric states that preventing overvoltage damage extends the supercap's lifespan, reduces maintenance costs and enhances power management reliability.

<https://www.anrictechnologies.com>

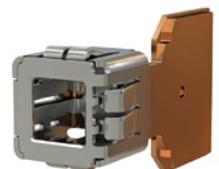


Connector system

Eaton (Southfield, Michigan) announced its High-Power Lock Box

SQ8 connector system for plug-in hybrid electric vehicles. Eaton states that unlike traditional copper-only terminals, the company's patented inverted design combines a stainless-steel spring with a copper current carrier. This design delivers up to 60% more current per unit volume and 30% lower resistance losses, all without tools or high insertion force. Eaton claims that this combination of performance, packaging and ergonomics could change how engineers approach battery disconnect units, high-voltage heaters and propulsion systems across EV and PHEV segments.

<https://www.eaton.com>



Factorial CEO: improved cells with 375Wh/kg energy density a ‘milestone’ for Stellantis

In April, **Stellantis** and **Factorial Energy** announced that the two companies validated automotive-sized solid-state battery cells with an energy density of 375Wh/kg. The companies called this “a major step toward commercial use.” Factorial’s cells can charge from 15% to over 90% in 18 minutes at room temperature and have discharge rates up to 4C. Stellantis invested \$75 million in Factorial in 2021. SAE Media recently spoke with Factorial CEO Siyu Huang about the partnership.

The Factorial Electrolyte System Technology (FEST) cells that Stellantis will use have a claimed energy density of 375Wh/kg. How are these different from the B-samples sent to Mercedes-Benz last year, which had a rating of over 106Ah while the Stellantis ones are 77Ah.

We’re not releasing technical spec sheets or comparing across programs, but what we can confirm is that the validated 77Ah FEST cells for Stellantis are large-format, automotive-sized solid-state batteries with an energy density of 375Wh/kg. The Ah rating relates to cell capacity. In general, differences like 77Ah vs. 106Ah reflect tailoring cells for specific vehicle platforms and performance requirements. For Stellantis, this validation is a milestone because it’s the first time a solid-state lithium-metal battery of this size has demonstrated both high energy density and durability over 600 charge cycles.

Stellantis will test these batteries in Dodge Charger Daytonas by 2026, and the companies are “closely collaborating on pack design” and on reducing weight and improving overall system efficiency. What challenges did the engineering teams face and find solutions for?

Stellantis and Factorial’s collaboration goes beyond cell development to jointly optimizing pack architecture, vehicle integration and system-level efficiency.

This includes reducing weight to extend range and improve performance. While we’re not sharing specific engineering workflows, the integration of solid-state batteries into a demonstration fleet by 2026 reflects progress on joint development milestones and real-world readiness.

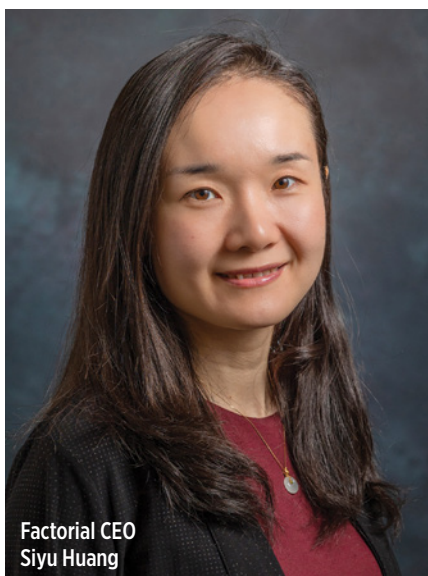
Can you share any technical details about how the collaboration goes “beyond cell development to optimizing pack architecture, improving vehicle integration, and enhancing overall range and cost efficiency”?

Factorial’s FEST technology offers higher energy density and the potential for smaller, lighter packs, giving OEMs more flexibility in vehicle design. The collaboration with Stellantis includes refining pack design and integration approaches to take full advantage of these benefits, with the goal of reducing overall system weight and improving both range and cost efficiency. This work is ongoing and tied directly to the demonstration fleet planned for 2026.

Tell me about Factorial’s “AI-driven tools.” How was AI used in the development of the cells, and how did AI change the process?

Factorial’s AI-driven tools played a key role in developing the latest FEST electrolyte formulation, which supports high-performance operation from -30 C to 45 C (-22 F to 113 F), helping to overcome traditional temperature limitations in solid-state batteries. AI accelerated electrolyte optimization and it enabled faster iteration to balance safety, energy density and fast-charging capability in large-format cells. We also use a digital twin to make more informed decisions about which physical experiments – such as electrolyte formulations – to run. In addition, we used it to forecast the cycle life of cell designs, which was later validated through physical testing.

Sebastian Blanco



Factorial CEO
Siyu Huang

“AI-driven tools played a key role in developing the latest FEST electrolyte formulation, which supports high-performance operation from -30 C to 45 C.”

WEBINARS

DESIGNING SECURE AUTOMOTIVE HSM SOLUTIONS

Tuesday, October 7, 2025 at 11:00 am U.S. EDT

Modern vehicles require advanced cybersecurity to protect critical systems. A fully open source and portable hardware security module (HSMS) framework simplifies embedded security across diverse automotive platforms by offloading cryptography, key management, and secure boot to dedicated hardware. This 60-minute webinar will offer a deep dive into automotive security solutions, including a lightweight secure bootloader built to integrate seamlessly with HSMs.



For additional details and to register visit: www.sae.org/webcasts

MAXIMIZING PRODUCTION PERFORMANCE WITH MES AND MOM

Tuesday, October 21, 2025 at 12:00 pm U.S. EDT

Shop floor systems are critical to continuous improvement and long-term success for transportation and mobility manufacturers, necessitated by stringent quality requirements, increasing product complexity, and ongoing supply chain issues. To address these challenges, manufacturers often turn to digital solutions like MES and MOS systems. This 30-minute webinar will explore real-life examples of how a true MOM solution, working in concert with other business systems, can improve key measures.



For additional details and to register visit: www.sae.org/webcasts

PHASE CHANGE MATERIALS IN ELECTRIC VEHICLES: TRENDS AND A ROADMAP FOR THE FUTURE

Available On Demand

The integration of phase change materials (PCMs) in electric vehicles (EVs) is gaining momentum as the industry seeks innovative solutions to enhance thermal management, improve energy efficiency, and extend device life. PCMs provide superior thermal management to traditional forced air or coolant systems. This 30-minute webinar delves into the recent advancements in PCM and hybrid thermal gel technologies and their implications for vehicle performance and sustainability.



For additional details and to register visit: www.sae.org/webcasts

ON DEMAND WEBINARS

NAVIGATING SECURITY IN AUTOMOTIVE SoCs: HOW TO BUILD RESILIENT SOLUTIONS

Available On Demand

In today's rapidly evolving automotive industry, ensuring the security of vehicles has become more critical than ever. Vehicles have become increasingly connected and autonomous, automotive OEMs are looking to centralize the hardware components in their vehicles, and software is becoming more complex due to artificial intelligence and machine learning. This 60-minute webinar delves into the latest advancements, challenges, standards for safety, and best practices in safeguarding modern vehicles from cyber threats.

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OPTIMIZING ELECTRIC POWERTRAINS: ADVANCED MATERIALS FOR PERFORMANCE, SAFETY, AND EFFICIENCY

Available On Demand

As the transition to electric vehicles progresses, manufacturers continue to face challenges in balancing performance, safety, and lightweighting. This 60-minute webinar explores advanced materials and technologies designed to optimize powertrain efficiency, with a focus on e-motors, power electronics, and batteries. In this program, experts share practical insights and real-world examples to elevate EV powertrain designs.

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FUTURE-PROOFING AUTOMOTIVE SOFTWARE: MODULARITY, REUSE, AND SAFETY WITH MODEL-BASED DESIGN

Available On Demand

Model-Based Design (MBD) is a development approach that uses models to design, simulate, and validate automotive systems and software. This 30-minute webinar discusses how to "future-proof" automotive software with MBD to enhance modularity, reuse, and safety in the SDV era. This webinar explores key strategies for decoupling software from hardware, designing for reuse, and overcoming industry challenges.

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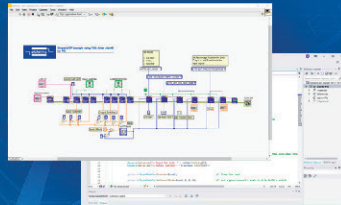


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